

UNITED STATES
NUCLEAR REGULATORY COMMISSION
OFFICE OF NUCLEAR REACTOR REGULATION
WASHINGTON, D.C. 20555

April 17, 1992

NRC INFORMATION NOTICE 92-29: POTENTIAL BREAKER MISCOORDINATION CAUSED BY INSTANTANEOUS TRIP CIRCUITRY

Addressees

All holders of operating licenses or construction permits for nuclear power reactors.

Purpose

The U.S. Nuclear Regulatory Commission (NRC) is issuing this information notice to alert addressees to potential breaker miscoordination involving instantaneous trip circuitry installed by the manufacturer in certain solid state trip units. It is expected that recipients will review the information for applicability to their facilities and consider actions, as appropriate, to avoid similar problems. However, suggestions contained in this information notice are not NRC requirements; therefore, no specific action or written response is required.

Description of Circumstances

On November 6, 1991, personnel at the Sequoyah Nuclear Plant (Sequoyah) calibrated a solid state trip unit in a 480 Volt power circuit breaker. The licensee had recently revised the procedure used for the calibration and had increased the test current required for measuring the response time of the short time delay trip element from 10 to 13.5 times the rating of the current sensor. When plant personnel applied the test current, the current caused the breaker to trip instantly rather than after the expected short time delay. The instantaneous trip indicated that breaker miscoordination existed between the 480 Volt power circuit breaker and any downstream load breaker.

Discussion

The trip unit was an "Amptector Solid State Trip Device" (Amptector) which was installed in a type DS power circuit breaker. Both the circuit breaker and the trip unit were manufactured by the Westinghouse Electric Corporation (Westinghouse). The licensee knew that the trip unit was equipped with a long and a short time delay element. However, the licensee did not know that the Amptector trip unit included a circuit which provided an instantaneous trip feature. After the unexpected instantaneous trip, the licensee reviewed the vendor's manual, "Westinghouse Instructions for Low-Voltage Power Circuit Breakers Types DS and DSL." In Section 8.3 of the manual the licensee found that Westinghouse had included a "making current release" feature in certain models of Amptector trip units not equipped with an instantaneous trip element. The manual

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referred to this feature as a "Discriminator." The Discriminator is a circuit in the trip unit which determines at the time of a fault whether or not there was any current flow in the primary circuit previous to the fault. The trip unit would trip instantaneously if (1) there was "no measurable current" flow previous to the fault, indicating that the circuit is just being closed or that another switching device upstream of the breaker has been closed, and (2) the current in the primary circuit exceeded approximately 12 times the sensor's rating. Otherwise, the short time delay element would function to delay the breaker tripping. Westinghouse stated that, in the event of a fault, this feature allowed the breaker to provide selectivity and continuity in unfaulted sections of a system so that service to those sections could be maintained but if there was no previously operating load in the faulted circuit the trip unit would function instantaneously to limit damage.

Based on the information found in Section 8.3, the licensee determined that the instantaneous trip that occurred during calibration of the above circuit breaker resulted from the Discriminator circuit sensing that there was no measurable current flow previous to the test and that the test current was greater than 12 times the sensor's rating. Previous calibrations of similar circuit breakers had not resulted in instantaneous trips because the test current was less than 12 times the sensor's rating. The licensee noted that, for the Discriminator feature, "no measurable current" is current flow that is less than approximately 10 percent of the sensor's rating.

The licensee determined that the Discriminator feature could cause breaker miscoordination in other electrical systems. This problem could occur in those systems in which a motor control center (MCC) serves both safety-related and nonsafety-related loads and current flow in the nonsafety-related portion of the circuit could be less than 10 percent of the sensor's rating. In these circuits, a fault on a nonsafety-related portion of the circuit could cause the safety-related MCC to become deenergized and result in the loss of the safety-related loads.

After consulting with Westinghouse, the licensee issued a design change to disable the Discriminator feature on 41 circuit breakers. Westinghouse stated that its DS type circuit breakers receive interrupting tests with the short and long time delay elements only (i.e. no instantaneous element) and disabling the Discriminator feature would not affect the interrupting ratings of the breakers. However, Westinghouse also indicated that disabling the Discriminator feature could increase the potential for equipment damage and personnel injury in downstream portions of the circuit.

Westinghouse informed the licensee that the Discriminator circuit had been a part of the Amptector trip unit since its first installation in DS type circuit breakers. However, Westinghouse did not address the Discriminator feature in the vendor's manual from the time of the manual's original issue in January 1971 until Revision C was issued in August 1976.

Licensees may have designed circuits without considering the effect of the Discriminator feature on breaker coordination because this feature was not

addressed in early revisions of the vendor's manual and because testing of the time delay elements with current less than approximately 12 times the sensor's rating may not reveal the presence of the Discriminator circuit.

The staff previously discussed the importance of proper breaker coordination in NRC Information Notice 88-45, "Problems In Protective Relay and Circuit Breaker Coordination," July 7, 1988.

This information notice requires no specific action or written response. If you have any questions about the information in this notice, please contact one of the technical contacts listed below or the appropriate Office of Nuclear Reactor Regulation (NRR) project manager.

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Computer Printout: see jacket

Attachment: List of Recently Issued NRC Information Notices

LIST OF RECENTLY ISSUED
NRC INFORMATION NOTICES

Information Notice No.	Subject	Date of Issuance	Issued to
92-28	Inadequate Fire Suppression System Testing	04/08/92	All holders of OLs or CPs for nuclear power reactors.
92-27	Thermally Induced Accelerated Aging and Failure of ITE/GOULD A.C. Relays Used in Safety-Related Applications	04/03/92	All holders of OLs or CPs for nuclear power reactors.
92-26	Pressure Locking of Motor-Operated Flexible Wedge Gate Valves	04/02/92	All holders of OLs or CPs for nuclear power reactors.
92-25	Potential Weakness in Licensee Procedures for A Loss of the Refueling Cavity Water	03/31/92	All holders of OLs or CPs for nuclear power reactors.
92-24	Distributor Modification to Certain Commercial-Grade Agastat Electrical Relays	03/30/92	All holders of OLs or CPs for nuclear power reactors.
92-23	Results of Validation Testing of Motor-Operated Valve Diagnostic Equipment	03/27/92	All holders of OLs or CPs for nuclear power reactors and all vendors of motor-operated valve (MOV) diagnostic equipment.
92-22	Criminal Prosecution and Conviction of Wrongdoing Committed by A Commercial-Grade Valve Supplier	03/24/92	All holders of OLs or CPs for nuclear power reactors.
92-21	Spent Fuel Pool Reactivity Calculations	03/24/92	All holders of OLs or CPs for nuclear power reactors.
92-20	Inadequate Local Leak Rate Testing	03/03/92	All holders of OLs or CPs for nuclear power reactors.

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